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Claims

[c1] 1. A control system for a hybrid vehicle having a power transfer unit adapted to drive a vehicle wheel and a power source adapted to drive the power transfer unit, the system comprising:
a local torque monitor associated with the power source and adapted to implement a local torque mitigation strategy to inhibit undesired torque; and
a vehicle level torque monitor adapted to implement a vehicle level torque mitigation strategy to inhibit acceleration of the hybrid vehicle if the local torque mitigation strategy does not successfully inhibit undesired torque.

[c2] 2. The system of claim 1 wherein the power source is an internal combustion engine.

[c3] 3. The system of claim 1 wherein the power source is a motor-generator.

[c4] 4. The system of claim 1 further comprising first and second power sources and first and second local torque monitors adapted to monitor and control the first and second power sources, respectively.

[c5] 5. The system of claim 4 further comprising a vehicle system control unit adapted to control the first and second power sources and receive commands from the vehicle level torque monitor when the vehicle level torque mitigation strategy is implemented.

[c6] 6. A method for monitoring and controlling torque in a hybrid vehicle, the hybrid vehicle having a power transfer unit adapted to drive a vehicle wheel, at least one power source adapted to provide a driving torque to the power transfer unit, a local torque monitor associated with the at least one power source, and a vehicle level torque monitor associated with the local torque monitor, the method comprising:

calculating first and second torque values representing estimates of the driving torque;

determining whether the first and second torque values are within a limit range;

implementing a local torque mitigation strategy with the local torque monitor to inhibit undesired torque if the first and second torque values are not within the limit range; and

implementing a vehicle level torque mitigation strategy with the vehicle level torque monitor if the local torque mitigation strategy does not cause the first and second torque values to fall within the limit range in a set period

of time.

[c7] 7. The method of claim 6 wherein the step of determining whether the first and second torque values are within the limit range further comprises sending a pass signal from the local torque monitor to the vehicle level torque monitor if the first and second torque values are within the limit range.

[c8] 8. The method of claim 6 wherein the step of implementing the vehicle level torque mitigation strategy further comprises sending a failure signal from the local torque monitor to the vehicle level torque monitor.

[c9] 9. The method of claim 6 wherein the step of implementing the vehicle level torque mitigation strategy further comprises calculating a first torque demand value indicative of acceleration demanded by a vehicle operator, calculating an estimated wheel torque value indicative of a torque provided to the vehicle wheel, and calculating an upper limit value indicative of a maximum acceptable torque at the vehicle wheel.

[c10] 10. The method of claim 9 wherein the hybrid vehicle further comprises a vehicle system control module and the step of implementing the vehicle level torque mitigation strategy further comprises determining whether the

first torque demand value is less than a second torque demand value provided by the vehicle system control unit to assess whether the vehicle system control unit has properly interpreted the acceleration demanded by the vehicle operator.

[c11] 11. The method of claim 10 wherein the step of implementing the vehicle level torque mitigation strategy further comprises comparing the estimated wheel torque value to the upper limit value to determine whether the vehicle is accelerating more than desired by the vehicle operator.

[c12] 12. The method of claim 11 wherein the step of implementing the vehicle level torque mitigation strategy further comprises commanding at least one power source to provide less driving torque if the estimated wheel torque value is greater than the upper limit value.

[c13] 13. A method for monitoring and controlling torque in a hybrid vehicle, the hybrid vehicle having a power transfer unit adapted to drive a vehicle wheel, a power source adapted to provide torque to the power transfer unit, a local torque monitor associated with the power source, a vehicle level torque monitor associated with the local torque monitor, and a vehicle system control unit adapted to receive commands from the vehicle level

torque monitor and control the power source, the method comprising the steps of:

determining first and second estimated torque values and implementing a local torque mitigation strategy with the local torque monitor to inhibit undesired torque if the first and second estimated torque values are not within a limit range;

implementing a vehicle level torque mitigation strategy if the local torque mitigation strategy does not cause the first and second estimated torque values to fall within the limit range in a set period of time, the vehicle level torque mitigation strategy including:

calculating an estimated wheel torque value indicative of a torque provided to the vehicle wheel and an upper limit value for estimated wheel torque value; and

implementing a torque control strategy if the estimated wheel torque value is greater than the upper limit value.

[c14] 14. The method of claim 13 wherein the vehicle level torque mitigation strategy repeats the calculating and implementing steps if the estimated wheel torque value is less than the upper limit value.

[c15] 15. The method of claim 13 wherein the step of calculating the estimated wheel torque value is based on a first signal indicative of a power transfer unit torque ratio and either the first or second estimated torque values.

[c16] 16. The method of claim 13 wherein the step of calculating the estimated wheel torque value further comprises calculating a first torque demand value indicative of a torque demanded by a vehicle operator, obtaining a second torque demand value from the vehicle system control unit, and comparing the first and second torque demand values to determine whether the vehicle system control unit properly interpreted the torque demanded by the vehicle operator.

[c17] 17. The method of claim 16 wherein the step of calculating the first torque demand value is based on a second signal indicative of an accelerator pedal position and a third signal indicative of a vehicle speed.

[c18] 18. The method of claim 13 wherein the step of implementing the local torque mitigation strategy further comprises reducing the torque provided by the power source to the power transfer unit.

[c19] 19. The method of claim 13 wherein the step of implementing the local torque mitigation strategy further comprises providing a fault mode signal to the vehicle level torque monitor.

[c20] 20. The method of claim 13 wherein the step of implementing the vehicle level torque control strategy further

comprises commanding the vehicle system control unit to reduce the torque provided by the power source.